

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Sakurai et al

Art Unit: 2615

Serial No.: 10/714,175

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Examiner: Andrew C. Flanders

Docket: TI-35254

For: FIXED-SIZE CROSS-CORRELATION COMPUTATION METHOD FOR AUDIO TIME
SCALE MODIFICATION

Appeal Brief under 37 C.F.R. §41.37

Board of Patent Appeals and Interferences

United States Patent and Trademark Office

P.O. Box 1450

Alexandria, VA 22313-1450

Dear Sir:

This is Appellant's Appeal Brief filed pursuant to 37 C.F.R.
§41.37 and the Notice of Appeal filed March 5, 2008.

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Real Party in Interest

The real party in interest in this application is Texas Instruments Incorporated, a corporation of Delaware with its principle place of business in Dallas, Texas. An assignment to Texas Instruments Incorporated is recorded at reel 015297 and frames 0517 to 0519.

Related Appeals and Interferences

There are no appeals of interferences related to this appeal in this application.

Status of the Claims

Claims 1, 3, 4 and 6 are rejected and subject to this appeal. Claims 2 and 5 are allowed. No claims are canceled.

Status of Amendments Filed After Final Rejection

The ADVISORY ACTION of February 26, 2008 stated that the amendments to the claims were proposed following the FINAL REJECTION of December 6, 2007 would be entered upon filing this appeal.

Summary of Claimed Subject Matter

The subject matter of independently argued claims 1, 3, 4 and 6 of this application is taught in the application as follows:

Claim 1	Description
1. A method of time scale modification of a digital audio signal comprising the steps of:	method: 600, page 3, lines 7 to 16, page 10, lines 9 to 11, page 11, lines 13 to 14
analyzing an input signal in a set of first equally spaced, overlapping time windows having a first overlap amount S_a ;	analyzing; 601, page 11, lines 14 to 17

selecting a base overlap S_g for output synthesis corresponding to a desired time scale modification;	selecting: 602, page 11, lines 17 to 21
calculating a cross-correlation $R[k]$ for index value k between overlapping frames for a range of overlaps between $S_g + k_{min}$ to $S_g + k_{max}$ for only a fixed length overlap region less than an entire overlapping region;	calculating: 603 to 607, page 11, lines 22 to page 12, line 7 fixed length overlap region: EFFECTIVE OVERLAP REGION Figure 5; page 10, line 26 to page 11, line 11
selecting a value K yielding the greatest cross-correlation value $R[k]$;	selecting: 608, page 12, lines 7 to 10
synthesizing an output signal in a set of second equally spaced, overlapping time windows having a second overlap amount equal to $S_g + K$.	synthesizing; 609, page 12, lines 9 and 10

Claim 3	Description
3. The method of claim 1, wherein:	method: 600, page 3, lines 7 to 16, page 10, lines 9 to 11, page 11, lines 13 to 14
said step of calculating the cross-correlation $R[k]$ employs only a center half of the overlap region for $k = 0$.	only center half: EFFECTIVE OVERLAP REGION Figure 5; page 10, line 26 to page 11, line 11

Claim 4	Description
4. A digital audio apparatus comprising:	apparatus: 100, page 4, line 8 to page 5, lines 27
a source of a digital audio signal;	source: 101, 103, page 4, lines 4 to 21
a digital signal processor connected to said source of a digital audio signal programmed to perform time scale modification on the digital audio signal by	digital signal processor: 123, page 4, line 24 to page 5, line 2; page 5, lines 17 to 20
analyzing an input signal in a set of first equally spaced, overlapping time windows	analyzing; 601, page 11, lines 14 to 17

having a first overlap amount,	
selecting a base overlap S_s for output synthesis corresponding to a desired time scale modification,	selecting: 602, page 11, lines 17 to 21
calculating a cross-correlation $R[k]$ for index value k between overlapping frames for a range of overlaps between $S_s + k_{min}$ to $S_s + k_{max}$ for only a fixed length overlap region less than an entire overlapping region;	calculating: 603 to 607, page 11, lines 22 to page 12, line 7 fixed length overlap region: EFFECTIVE OVERLAP REGION Figure 5; page 10, line 26 to page 11, line 11
selecting a value K yielding the greatest cross-correlation value $R[k]$,	selecting: 608, page 12, lines 7 to 10
synthesizing an output signal in a set of second equally spaced, overlapping time windows having a second overlap amount equal to $S_s + K$; and	synthesizing: 609, page 12, lines 9 and 10
an output device connected to the digital signal processor for outputting the time scale modified digital audio signal.	output device: 130, page 5, lines 23 to 27

Claim 6	Description
6. The digital audio apparatus of claim 4, wherein:	apparatus: 100, page 4, line 8 to page 5, lines 27
said digital signal processor is programmed to calculate the cross-correlation $R[k]$ employing only a center half of the overlap region for $k = 0$.	only center half: EFFECTIVE OVERLAP REGION Figure 5; page 10, line 26 to page 11, line 11

Grounds for Rejection to be Reviewed on Appeal

Claims 1, 3, 4 and 6 were rejected under 35 U.S.C. 102(e) as anticipated by Crockett U.S. Patent Application Publication No. 2004/0122663.

Arguments

Claims 1, 3, 4 and 6 were rejected under 35 U.S.C. 102(e) as anticipated by Crockett U.S. Patent Application Publication No. 2004/0122663.

Claims 1 and 4 recite subject matter not anticipated by Crockett. Claims 1 and 4 recite "calculating a cross-correlation $R[k]$ for index value k between overlapping frames for a range of overlaps between $S_s + k_{\min}$ to $S_s + k_{\max}$ for only a fixed length overlap region less than an entire overlapping region." The FINAL REJECTION cites paragraphs [0152] to [0157] and step 210 illustrated in Figure 5 of Crockett as making obvious calculating the cross-correlation. These paragraphs of Crockett teach unspecified optimization in determination of a common splice point for multiple input channels. This fails to make obvious calculation of a cross-correlation is limited to the "fixed length overlap region less than an entire overlapping region" as recited in claims 1 and 4. These paragraphs of Crockett fail to include any mention of correlation. These paragraphs of Crockett fail to include any teaching of the recited calculating range of "a range of overlaps between $S_s + k_{\min}$ to $S_s + k_{\max}$." The unspecified optimization of Crockett is between pairs of the multiple input channels. This differs from the cross-correlation between an analysis function and a synthesis recited in claims 1 and 4. Crockett teaches using "overlapping identified regions" in determining common splice points. However, Crockett includes no teaching that the cross-correlation calculation occurs within "a fixed length overlap region" that is less than the entire overlap. Crockett fails to teach any limitation on the overlap region for calculation of a cross-correlation. Accordingly, claims 1 and 4 are allowable over Crockett.

After quoting a portion of the Applicants' arguments from the response filed October 23, 2007, the FINAL REJECTION states at page 2, line 27 to page 3, line 3:

"Examiner respectfully disagrees. Applicant states that these sections of Crockett fail to mention correlation, however, these paragraphs are directed to finding a common splice point of the signal. The system analyzes where to place this splice point. The regions are ANDed together to yield a common overlap segment. This step of analyzing determines where to place the splice between two segments (i.e. the correlation between the segments). The section also discusses identifying potential splice points, i.e. 'a range of overlaps.'"

These statements by the Examiner represent a summary of the teachings of paragraphs [0152] to [0157] of Crockett. However, the Examiner has provided no indication how these teachings of Crockett relate to the recited limitations. Crockett at paragraph [0150], lines 11 to 14 the range of overlaps refer to "overlapping identified regions." Crockett defines such identified regions in paragraph [0011], which states:

"[0011] According to still yet a further aspect of the invention, the psychoacoustic criteria include one or more of the following: (1) the identified region of the audio signal is substantially premasked or postmasked as the result of a transient, (2) the identified region of the audio signal is substantially inaudible, (3) the identified region of the audio signal is predominantly at high frequencies, and (4) the identified region of the audio is a quieter portion of a segment of the audio signal in which a portion or portions of the segment preceding and/or following the region is louder. Some basic principles of psychoacoustic masking are discussed below."

The ANDing of such identified regions taught in paragraph [0152] would result in "overlapping identified regions" including all locations where any channel signal met the four criteria of paragraph [0011]. This AND of all identified regions thus cannot

anticipate "a fixed length overlap region less than an entire overlapping region" as recited in claims 1 and 4. The Applicants respectfully submit that the cited portions of Crockett teach a process unrelated to the claimed limitation. Accordingly, claims 1 and 4 are allowable over Crockett.

The ADVISORY ACTION of February 26, 2008 states at the continuation of paragraph 11 at page 2, lines 11 to 19:

"Examiner respectfully disagrees. These calculations occur at specific intervals. These specific intervals met the limitations of a 'fixed length overlap region,' specifically, the identified regions. These regions, after identified are considered to be fixed length, as they are not substantially changing. For example, a silent region isn't going to change from silent to audible. This specific region, can be considered less than an entire overlapping regions. For example, multiple silent regions in the audio track could be identified. The sum (or span from beginning of silent region 1 to the end of silent region n+1) of these read upon the entire overlapping regions. Thus, a single identified location, would be less than the entire region."

This argument of the Examiner evidences confusion between two quantities treated differently in claims 1 and 4. The two confused quantities are: (1) the region where the value K produces the greatest cross-correlation; and (2) the recited "fixed length overlap region less than an entire overlapping region" where the cross-correlation calculation takes place. The Examiner's argument is that the value K yielding the greatest cross-correlation value could be anywhere within the range of overlaps "between $S_g + k_{\min}$ to $S_g + k_{\max}$." Thus the Examiner argues that this satisfies the limitation of the "fixed length overlap region less than an entire overlapping region." This is not the limitation claimed. The actual limitation claimed is that the calculation of the cross-correlation occurs only in "a fixed length overlap region less than an entire overlapping region." This limitation is described in the

application at page 10, line 9 to page 11, line 11. In Figure 5 the fixed length overlap region is denoted "EFFECTIVE OVERLAP REGION." As described in the application the prior art calculates the correlation based upon the region denoted "OVERLAP REGION" in Figure 5. Crockett includes no teaching that would lead one skilled in the art to believe that Crockett does not use this prior art. The Examiner has not shown where Crockett teaches a cross-correlation calculation is limited to "a fixed length overlap region less than an entire overlapping region" as required by claims 1 and 4. Thus while the value K resulting in the greatest cross-correlation could fall anywhere within the range "between $S_s + k_{\min}$ to $S_s + k_{\max}$," Crockett fails to teach any limitation upon the region for which the cross-calculation takes place. Accordingly, claims 1 and 4 are allowable over Crockett.

Claims 3 and 6 recite subject matter not anticipated by Crockett. Claims 3 and 6 recite the cross-correlation calculation employs "only a center half of the overlap region for $k = 0$." The FINAL REJECTION cites paragraphs [0152] to [0157] and [0252] of Crockett as anticipating this limitation. Paragraphs [0152] to [0157] of Crockett teach selecting a common multichannel splice point considering "overlapping identified regions" between the channels. This teaching of Crockett fails to limit calculation of the cross-correlation to the "center half of the overlap region" as recited in claims 3 and 6. Crockett states at paragraph [0252]:

"[0252] The value of the correlation function at its maximum between the minimum and maximum end points determines how similar the splice point is to the optimum end point for the particular splice point. In order to optimize the splice point/end point pair (rather than merely optimizing the end point for a particular splice point), a series of correlations are computed by choosing other T_c sample splice point regions each located N samples to the right of the previous region and by recomputing the correlation function as shown in FIG. 28."

This paragraph of Crockett refers to the "value of the correlation function at its maximum between the minimum and maximum end points." This implies that the correlation is calculated for all points between "the minimum and maximum end points." This teaching contradicts the recitations of base claims 1 and 4 of calculating a cross-correlation "for only a fixed length overlap region less than an entire overlapping region." The recitation of "choosing other Tc sample splice point regions each located N samples to the right of the previous region" fails to teach the claimed "only a center half of the overlap region for $k = 0$ " recited in claims 3 and 6. Accordingly, claims 3 and 6 are allowable over Crockett.

After quoting a portion of the Applicants' arguments from the response filed October 23, 2007, the FINAL REJECTION states at page 3, lines 15 to 17:

"Examiner respectfully disagrees. Para 252 teaches that the splice point is selected (sic) to be the optimum end point. This end point could fall within any area of the segment, one of which area being the center region, as claimed in claim 3."

The ADVISORY ACTION of February 26, 2008 states at the continuation of paragraph 11 at page 3, lines 9 to 12:

"Examiner respectfully disagrees. In addition to what is stated above regarding claims 1 and 4, it should be noted that depending upon the determined splice point, the device could determine a point only the center of the identified regions. Since it could fall at any location, it can reasonably be assumed to anticipate this limitation."

The ADVISORY ACTION further states at the continuation of paragraph 11 at page 3, line 25 to page 4, line 2:

"Examiner respectfully disagrees. While the limitation does not explicitly recite where the selected value K

'yielding the greatest cross-correlation' will occur, the limitation call for the overlap region where the correlation calculation takes place. The location yielding the greatest cross-correlation will define the overlap region where the correlation takes place. In the prior art, this could be anywhere the system determines is applicable, one of which being a center region."

These statements by the Examiner represent a misunderstanding of the limitation recited in claims 3 and 6. This limitation does not recite where the selected value of K "yielding the greatest cross-correlation" will occur. This limitation of claims 3 and 6 limits the overlap region where the correlation calculation takes place to a center half of the overlap region. This limitation is described in the application at page 10, line 9 to page 11, line 11. In Figure 5 the fixed length overlap region is denoted "EFFECTIVE OVERLAP REGION." As described in the application the prior art calculates the correlation based upon the region denoted "OVERLAP REGION" in Figure 5. Crockett includes no teaching that would lead one skilled in the art to believe that Crockett does not use this prior art. Thus the Examiner's argument that the "end point could fall within any area of the segment, one of which area being the center region" is not in the same field as the limitation of claims 3 and 6. An argument that the end point may be within the center region, fails to make obvious the recitation of claims 3 and 6 that the correlation calculation takes place "only a center half of the overlap region for $k = 0$." Accordingly, claims 3 and 6 are allowable over Crockett.

If the Examiner has any questions or other correspondence regarding this application, Applicants request that the Examiner contact Applicants' attorney at the below listed telephone number and address to facilitate prosecution.

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CLAIMS APPENDIX

1 1. A method of time scale modification of a digital audio
2 signal comprising the steps of:

3 analyzing an input signal in a set of first equally spaced,
4 overlapping time windows having a first overlap amount S_s ;

5 selecting a base overlap S_s for output synthesis corresponding
6 to a desired time scale modification;

7 calculating a cross-correlation $R[k]$ for index value k between
8 overlapping frames for a range of overlaps between $S_s + k_{min}$ to
9 $S_s + k_{max}$ for only a fixed length overlap region less than an entire
10 overlapping region;

11 selecting a value K yielding the greatest cross-correlation
12 value $R[k]$;

13 synthesizing an output signal in a set of second equally
14 spaced, overlapping time windows having a second overlap amount
15 equal to $S_s + K$.

1 3. The method of claim 1, wherein:

2 said step of calculating the cross-correlation $R[k]$ employs
3 only a center half of the overlap region for $k = 0$.

1 4. A digital audio apparatus comprising:

2 a source of a digital audio signal;

3 a digital signal processor connected to said source of a
4 digital audio signal programmed to perform time scale modification
5 on the digital audio signal by

6 analyzing an input signal in a set of first equally
7 spaced, overlapping time windows having a first overlap
8 amount,

9 selecting a base overlap S_s for output synthesis
10 corresponding to a desired time scale modification,

11 calculating a cross-correlation $R[k]$ for index value k
12 between overlapping frames for a range of overlaps between
13 $S_s + k_{\min}$ to $S_s + k_{\max}$ for only a fixed length overlap region
14 less than an entire overlapping region;
15 selecting a value K yielding the greatest cross-
16 correlation value $R[k]$,
17 synthesizing an output signal in a set of second equally
18 spaced, overlapping time windows having a second overlap
19 amount equal to $S_s + K$; and
20 an output device connected to the digital signal processor for
21 outputting the time scale modified digital audio signal.

1 6. The digital audio apparatus of claim 4, wherein:
2 said digital signal processor is programmed to calculate the
3 cross-correlation $R[k]$ employing only a center half of the overlap
4 region for $k = 0$.

Evidence Appendix

None

Related Proceedings Appendix

None